980 Ninth Street, Suite 1500
Sacramento, CA 95814
www.deltacouncil.ca.gov

Lead Scientist's Report

Summary: This report includes six items: (1) Summary of the Sacramento Valley Salmon Resiliency Strategy (Salmon Strategy); (2) Journal article summary on how floodplain farm fields provide novel rearing habitat for Chinook salmon; (3) Summary of one poster from the 2016 Bay-Delta Science Conference on the differential impacts of outmigration, survival, and biocomplexity for the Central Valley Chinook salmon population; (4) Summary of the Delta Smelt Resiliency Strategy's (Smelt Strategy) first year progress report; (5) Announcement of the Delta invasive species workshop; and (6) By the Numbers Report.

Sacramento Valley Salmon Resiliency Strategy

http://resources.ca.gov/docs/Salmon-Resiliency-Strategy.pdf

In June 2017, the California Natural Resources Agency (Resources) published the Salmon Strategy to provide resource agencies, the public, Congress, and the California State Legislature guidance on best practices to address short and long-term needs of winter- and spring-run Chinook salmon and California Central Valley steelhead. The Salmon Strategy relies on the 2014 National Marine Fisheries Service Final Recovery Plan for winter-run, spring-run, and steelhead and is informed by seven science-based conceptual models developed through the Interagency Ecological Program. These conceptual models depict key factors and stressors (e.g., floodplain connectivity and predation risks) affecting the population dynamics of winter-run Chinook salmon in various life stages and were used to identify 13 proposed habitat restoration management actions to improve salmon and steelhead resiliency.

Four of the Salmon Strategy's 13 habitat restoration management actions are specific to the Delta: 1) improvement of adult fish passage through the Yolo Bypass; 2) increase in juvenile salmonid access to Yolo Bypass and an increase in the duration and frequency of Yolo Bypass floodplain inundation; 3) construction of a permanent Georgiana Slough non-physical barrier; and 4) restoration of tidal habitat in the Delta. A major objective of these four management actions is to advance adult and juvenile access to, and passage through, the Yolo Bypass. This is would be done by modifying and removing barriers in the area, increasing the duration and frequency of inundation, and improving floodplain and tidal habitat. The other nine actions address spawning, rearing, and adult fish passage issues upstream of the Delta. For each of the 13 actions, the strategy details objectives, linkages to the conceptual models, consistency with existing priorities (e.g., California EcoRestore), funding estimates and sources, and timing.

Four additional actions to improve salmon resiliency (e.g., further evaluate impacts and mechanisms of predation on out-migrating juvenile Chinook salmon along various portions of the Sacramento River) are also included as guides for future work.

Floodplain Farm Fields Provide Novel Rearing Habitat for Chinook Salmon Katz, J., V., E.; Jeffres, C.; Conrad, J., L.; Sommer, T., R.; Martinez, J.; Brumbaugh, S.; Corline, N.; Moyle, P., B. *PLoS One. June 7, 2017.*
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0177409
The Chinook salmon currently is a species of special (federal) concern. California's Central Valley once was home to one of the largest runs of Chinook salmon in the world. Historically, these fish had access to vast rearing habitats, including seasonal floodplains. Now, flood control and agricultural activity have led to the removal of more than 95 percent of those historic floodplains, and large rim dams have restricted fish access to large regions of historic spawning areas.

Scientists are researching ways to manage landscapes that increase Chinook salmon survival throughout their complex life cycle. One promising strategy is to try to provide access to floodplains for which the salmon are adapted at critical times in the life cycle of these fish. This recently published paper examined if rice fields could be flooded in the winter and early spring to act as beneficial habitat for juvenile salmon. To do this, researchers introduced approximately 10,000 juvenile salmon to flooded fields for six weeks. Researchers flooded rice fields while they were not in use (between harvesting and planting seasons). The fields were located in the Yolo Bypass, an area accessible to the salmon's migration pathway. Researchers examined the food resources of the "surrogate" floodplains. They also studied the growth rate and stomach content of the juvenile salmon.

The results showed very clearly that managed flooding of agricultural land could produce beneficial habitats desirable to Central Valley salmon. The growth rates of the salmon in these fields were among the highest rates ever recorded in the Central Valley. The flooded fields provided rearing habitats that promoted high-quality food that stimulated the growth of the fish. This study showed conclusively that some functional agricultural landscapes could be managed for the combined benefits of farming, flood protection, fish, and other wildlife. Optimizing the beneficial use of these floodplains during periods when crops are not being grown is a research goal very amenable to an active adaptive management approach.

Poster Summary from the 2016 Bay-Delta Science Conference

Differential impacts of outmigration, survival, and biocomplexity for the Central Valley Chinook fall salmon population. Nussle, S.; Sturrock, A.; Hendry, A.; Johnson, R.; Carlson, S.
Multiple factors affect the outmigration, survival, and return of adult salmon to their spawning grounds. This biocomplexity creates challenges for designing effective management strategies to maximize salmon population sizes. This study of Central Valley Chinook fall-run salmon examined factors, particularly size at outmigration toward the ocean, which influence the population size of returning adult fall-run Chinook salmon. Two research questions guided this effort: 1) What are the main factors

influencing total adult populations; and 2) Does diversity in size at outmigration increase population stability?

The adult production of fall-run Chinook salmon from the Stanislaus River was estimated using a life-history model that examined four parameters that all varied considerably between wet and dry years: 1) outmigrant abundance; 2) outmigrant size distribution; 3) outmigrant survival; and 4) outmigrant survival-by-size. Using these factors, researchers estimated the number of outmigrants in each size category, the number of returning adults, and the survival of individuals as a function of their size.

This study found returning adult population size to be strongly affected by the number of outmigrants leaving the Stanislaus River and making their way towards the Bay and Delta; thus, management efforts to increase juvenile survival have the largest potential to increase adult production. Variability in the successful return of adults were found to be stabilized by increased diversity in the size of juvenile outmigrants; consequently restoration activities should focus on promoting flexible migration strategies that consider both the volume of outmigrants and their physical variability in size. Other parameters that could improve the life history model and provide more robust estimates of adult production include the addition of considerations for flow and ocean conditions.

Delta Smelt Resiliency Strategy – Progress Report
http://resources.ca.gov/docs/Delta-Smelt-Resiliency-Strategy-Update.pdf
Resources recently released a progress report on the implementation of the Smelt Strategy (initially released in July 2016). The report provides a status update on the 13 near- and mid-range actions aimed at creating better habitat, more food, and higher turbidity for delta smelt, along with reducing weeds, predators, and harmful algal blooms. The progress report details actions taken by the California Department of Water Resources (DWR), the California Department of Fish and Wildlife (DFW), the U.S. Bureau of Reclamation, the State Division of Boating and Waterways (DBW), the U.S. Fish and Wildlife Service, and the State Water Contractors (SWC) over the past year to reduce delta smelt mortality and to improve conditions for growth, reproduction, and survival.

The progress report highlights several activities to improve delta smelt habitat. Included are efforts by DWR, DFW, and DBW to assess the effects of herbicides on non-target weed species in a 200-acre area of delta smelt habitat. Additionally, the SWC have prepared an adaptive management plan for potentially reopening the Suisun Marsh Salinity Control Gates during drier summer months to lower salinity levels in the Sacramento River. Reoperation of the salinity control gates could occur in 2018. DWR is in the process of assessing the practicality of the associated engineering, modeling, and permitting plans.

Two other potential actions for augmenting delta smelt habitat are 1) the addition of sediment to increase turbidity in the low-salinity zone (currently under review by the SWC to determine how much additional sediment is required, what type of sediment would be used, and what spatial and temporal scale is would be distributed over); and

2) enhancement of sand in areas where pre-spawning adults have been found (also under review to determine where the addition of sand would be best applied).

Other wetland restoration efforts such as the Tule Red project (which began last fall and will restore 400 acres in Suisun Marsh to tidal activity) and restoration on Dutch Slough, Hill Slough, Decker Island, Lower Yolo Ranch, Bradmoor Island, and Frank's Tract are also proposed. These restoration projects are currently undergoing feasibility studies or slated to begin in the coming year.

The report also highlights efforts to enhance delta smelt food supplies. In the summer of 2016, DWR and DFW worked with multiple agencies and farmers to release "pulse flows" of water into the Delta through the Yolo Bypass, prompting a phytoplankton bloom that was able to support enhanced numbers of zooplankton, a food source for delta smelt. Similar to the benefits of winter and early spring pulse flows into the Delta; seasonal outflows have the potential to buffer the adverse effects of predation, harmful algal blooms, and food shortages. As this current water year is the wettest on record, scientists are currently looking at how large outflow conditions affect Delta ecosystems and their species.

Upcoming Delta Invasive Species Symposium
On Tuesday, August 29, the Delta Interagency Invasive Species Coordination Team (DIISC) in conjunction with the Council and the University of California, Davis (UC Davis) will be hosting a Delta invasive species symposium. The symposium will take place at the UC Davis Conference Center and is intended for anyone in the Delta science community interested in invasive species issues. Presentations will explore tools and actions being developed to meet today's management needs as well as to prepare for future challenges. The symposium will also explore our understanding of how habitats can be managed to encourage native species and deter invasive species, and how social science can be better integrated into invasive species management. To register for the event and/or view the draft agenda, please visit the DIISC webpage: http://deltaconservancy.ca.gov/delta-inter-agency-invasive-species-team/. Registration will be open until capacity is reached.

By the Numbers
Delta Science Program staff will give a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

List of Attachments

Attachment 1: By the Numbers Summary (*report to be provided at the Council Meeting*)

Contact

Dr. Cliff Dahm
Lead Scientist
Phone: (916) 445-0463